PROCEEDINGS

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"Innovation, Development and Utilition of Research and Community Service"

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Theme : **Innovation, Development and Utilition of Research and Community Service**

Keynote Speaker :

1. **Inocencio E. Buot Jr.** (Prof.Ecology and Biodiversity, Faculty of Management and Development Studies University of The Philippines, Los Banos): Biodiversity Research and Community Experiences, Conclusion and Recommendations
2. **Dr. Primo Garcia** (UPOU, Philippines: Research, Instruction and Publics Service in an Open Learning System: The Innovation Nexus at Up Open University).
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FOCUS On INDUSTRIES

THE DURATION EFFECT OF THE BLEACHING PROCESS OF PALM OIL TO THE RED COLOR'S ABSORPTION BY USING ACTIVATED TRASS ROCK

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ABSTRACT

Some factors to be considered in bleaching process of palm oil are such as heating temperature, the amount of bleaching material and the duration of bleaching process itself. This was aimed at obtaining the clear yellow color of frying oil being produced. However, before bleaching process, palm oil had to be treated degumming process and neutralisaion at first. Meanwhile, as a bleaching material, activated trass rock of HCl was required for bleaching process. The weight of bleaching material was 4% of the palm oil wight with some variations of bleaching time: 15, 25, 35, 45 and 55 minutes and its heating temperature was 240 °C. Furthermore, among those variations, it was known that the best bleaching time of 15 minutes was obtained that its red color's intensity was 15 and yellow was 38,9 with its FFA of 1,44% and peroxide number was 7,30 meq O_2/kg.

Keywords: Trass rock, bleaching , color's absorption, palm oil

INTRODUCTION

If frying oil is heated for a longtime with a high temperature, it will make it defective. Therefore, in bleaching process, time and heating temperature must be regarded. Meanwhile, some factors which might affect the bleaching process are covering the particle's size of bleaching material, the percentage between oil and its bleaching material, bleaching temperature and its contact duration between oil and its bleaching material (Nwabanne , 2013).

Bleaching process is the color's absorption or omission from other chemical compounds exists in palm oil causing some certain unwanted smell and taste. Therefore, bleaching process seems to be as a direct contact between palm oil and active surface which is capable of absorbing some unwanted particles is required (Usman, 2013). Furthermore, Egbuna (2013) said that there was a bleaching material from the activated clay in efforts to reduce the red color's intensity. Based on his experiment, it was said that this material could be used as a bleaching material having the red color's absorption of palm oil. (During the bleaching process, red color, peroxide and some other dirt could be removed from the raw material of palm oil. Therefore, after bleaching process completed, the color of palm oil produced became clearer and could increase its stability of production (Falaras, 2000). Furthermore, bleaching earth can also be used to remove some chlorophyl, carotenoids, phosphorlipids, metals and oxidation product from oil just by adsorption (Makhoukhi, 2009). However, the equilibrium achieved for bleaching process each oil material is different between one and another. For example, in an experiment of corn oil, the equilibrium could be achieved after 2 hours at the temperature of 45ºC and after 30 minutes of 85ºC. On the other hand, for the sunflower oil, the equilibrium could be achieved faster, at the temperature of 45ºC after 40 minutes. Meanwhile at the temperature of 85ºC the equilibrium could be achieved after 15 minutes only (Christidis, 2003).Moreover, some certain physical characteristics dealing with crude palm oil to be recognized are such as its color, the content of free fatty acid, taste, smell and other chemical properties. These should be considered to be another parameter in efforts to obtain the quailed palm oil as a final product (Egbuna , 2013). As a vegetable oil, palm oil has a rich minor component of nutrient containing some various carotenes from 500-700 ppm. The highest carotenes are those of α- and β. Meanwhile the carotene contained in palm oil is about 90% from the total of all carotenes. β-carotene is the most important factor of vitamin A provider. Besides, carotene takes an important role to prevent from cancer disease, cataract and other degenerative disease, like heart attack (Wei, 2004). As we know that palm oil is produced from oil taken from its flesh of fruit with its color of reddish orange due to its high content of carotenoide pigment and dirt, like free fatty acid (Egbuna, 2013). In line with the explanation above, in order to achieve the bleaching performance optimally and economically from bleaching process, we have to consider the following things, such as: the kind and quality of

oil, degumming and neutralization as well as the characteristics of oil being used, processing condition and layout of the process equipments required (Salawudeen, 2014). Degumming process is meant to omit the gum contained in the crude palm oil and to precipitate *phosphatide* which is not soluble in the water without reducing fatty acid in the palm oil. Meanwhile, neutralization process is aimed at reducing or removing the free fatty acid contained in the palm oil. In neutralization process, the addition or the concentration of NaOH solution required must be estimated very well so that the oil produced will not lose too much. The low content of water in the crude palm oil might cause the low content of free fatty acid. Meanwhile the water content might influence the percentage of free fatty acid contained in oil and this content must be reduced up to 0,15% until 0,25% to prevent the increase of free fatty acid through autocatalytic reaction, (Okolo, 2014). Due to the reaction between water and oil (trigliserida) in palm oil which might produce some gliserol and free fatty acid so that this condition might make the content of free fatty acid in palm oil become higher also. Furthermore, the raw material of oil used for frying oil should be that of containing much unsaturated fatty acids. This oil condition is called the healthy oil rather than that of containing much saturated fatty acid. Due to the unsaturated fatty acids contained in oil is quite much, oxidation will happen more easily. Therefore, we are suggested not to use frying oil time after time (many times) because it might make the amount of unsaturated fatty acids be getting less and the saturated fatty acid is getting more and higher. The more often the frying oil is used, the unsaturated fatty acids is getting less and the saturated fatty acid is getting more or higher. This condition might make its peroxide number of oil will also increase due to the repeated heating and oil runs into oxidation (Leong, 2012).

This research aimed at obtaining the best duration condition of bleaching process of palm oil using the activated trass rock of HCL as a bleaching material. Therefore, some variations of experiment dealing with the duration of bleaching process were conducted in order to find the most precise time to make the red color of palm oil be absorbed as much as possible.

METHODOLOGY

The main materials required in this research were such as the activated trass rock of HCl, NaOH, phosphate acid of 85% and aquades of crude palm oil (CPO). Meanwhile, some instruments required were stove/heater, tank or beker glass, mixer, filter paper, funnel and thermometer.

This research was conducted within 2 (two) stages, they were preparation process of palm oil material and bleaching process. At first, the raw material of oil to be used was analyzed its content of free fatty acid (FFA) and its peroxide number to know the former quality of palm oil. We needed 21 liters of palm oil material for preparation process to obtain the same condition when bleaching process was conducted. Then degumming process was conducted to those 21 liters of palm oil material by heating it until the temperature was reaching up by heating until the temperature was reaching up to 80°C. After that phosphate acid of 85% was added as much as 0.15% of the palm oil weight. Then, it was stirred for 15 minutes. The next, neutralization process was conducted by reducing its heating temperature up to 60°C and some solution of NaOH with its concentration of 11,1% (160 Be) as much as 6% of the volume of palm oil was added and stirred for 25 minutes. After being cooled, it was filtered or refined to separate the oil from its soap. This neutralized oil was then analyzed its content of FFA, peroxide number and iod number by using titrimetri method. Meanwhile, for the color's intensity employing lovibond method, tintometer series E was used. Having the preparation process of palm oil material been finished, the next step was bleaching process. In this process, we needed 300 grams of palm oil added with activated trass rock of HCL as much as 4% of the weight of palm oil or 12 grams of activated trass rock. This activated trass rock was obtained by activating the trass rock with HCl solution with its proportion 1:10 for 4 hours at the activation temperature of 105°C. Furthermore, in bleaching process, we conducted several variations of bleaching duration: 15, 25, 35, 45 and 55 minutes with heating temperature of 240°C. Having been weighed, the palm oil was put into the beker glass of 500 ml then heated until reaching up to the required temperature. Then the activated trass rock that had already been prepared was

put into this hot oil and stirred until reaching up to the determined time. After bleaching process completed, the oil was filtered to separate the oil from its bleaching material. After being filtered, the oil was analyzed for its color's intensity by using lovibond method employing Tintometer test series E. Meanwhile, for the content of FFA and peroxide number, we used titrimetri method.

RESULT AND DISCUSSION

Based on the analysis result, it was known that the quality of former raw material of palm oil before being neutralized could be seen on table 1 below:

Table- 1: Analysis Data of Former Palm Oil

Material	FFA (%)	Peroxide Number (Meq O_2/Kg)
Palm Oil	5.70	12.28

Furthermore, the analysis result of palm oil after being neutralized could be seen on table 2 below:

Table- 2. Data of the Analysis Result of Palm Oil After Being Neutralized

Palm Oil After Being Neutralized	Color's Intensity		FFA (%)	Peroxide Number (Meq O_2/Kg)
	Red	Yellow		
	59	30	1,98	7,70

Meanwhile, the good analysis result of palm oil after bleaching process could be seen on table 3 below:

Table- 3. Data Analysis of Palm Oil After Bleaching Process

Bleaching Time (Minutes)	Bleaching Temperature (°C)	Color's Intensity Oil		FFA (%)	Peroxide Number (meqO_2/kg)
		Red	Yellow		
15		15	38,9	1,44	7,30
25		16,8	48	1,34	4,89
35	240	18,9	49,9	1,46	4,86
45		19	59,9	1,28	6,11
55		22,6	79,9	1,28	7,00

The result of neutralization process was in fact capable of reducing the free fatty acid and peroxide number contained in palm oil. This fact might be seen on Table 1 and 2. Based on the experiment, the former peroxide number was decreasing from 12,28 meq O_2/kg to 7,70 meq O_2/kg. Meanwhile, the free fatty acid was decreasing from 5,70% to 1,98%. The decrease of FFA was due to the reaction between FFA and NaOH solution resulting into soap and glycerol.

Bleaching process of palm oil was mainly how the red color contained in the palm oil could be entirely reduced or absorbed by the bleaching material of activated trass rock (as it was stated by Egbuna, 2013) so that the oil could turn clear yellow like the frying oil in general. However, bleaching process could also reduce the other unwanted materials such as FFA and peroxide number contained in the palm oil (See Table 3). The same thing was also stated by Falaras (2000). Furthermore, this research was trying to find the operation condition of bleaching process by seeing the effect of several variations of bleaching time especially dealing with the activated trass rock as a bleaching material. Having conducted some experiments, it was known that the duration of bleaching process in fact took an important role to the oil result obtained both dealing with the color's absorption and the absorption of other elements. Figure 1 (One) below showed several variations of duration effect of bleaching process to the absorption of red color:

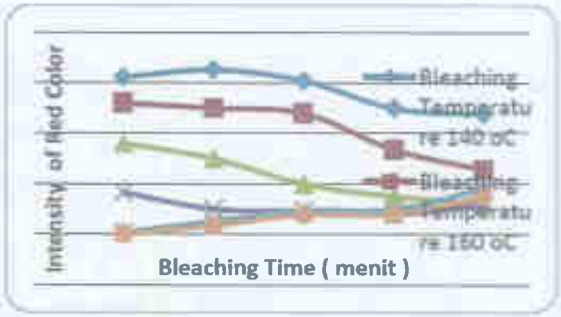

Figure- 1. The Relationship Between the Duration of Bleaching Process and the Intensity of Red Color

Figure 1 above showed that the duration of bleaching process took an important role in the absorption of red color contained in palm oil. It was known that the low temperature with the longer time the absorption of red color was getting higher so that the intensity of red color seemed to be decreasing. This could happen

because during the bleaching process the equilibrium had not been achieved so that the absorption process was still going on. On the other hand, the high temperature of 200°C, 220°C and 240°C, it was known that the longer the time of bleaching process the intensity of red color of palm oil tended to increase. This might happen because at a certain time of absorption during bleaching process, the equilibrium had already occurred. Meanwhile, due to the time of bleaching process which was still going on, the equilibrium would turn not be equilibrate any more. This condition might cause the red color be released or absorbed again by the oil. Therefore, the equilibrium during the bleaching process was a very important thing to consider (Christidis, 2003). During the bleaching process, palm oil with the high temperature, the equilibrium of color's absorption could be achieved faster than that of the lower one. This was due to the fact that oil at a high temperature, it was getting more aqueous or was reducing the viscosity of oil (Ejikeme, 2013). This condition might make the contact between oil and its surface of bleaching material. Moreover, the red color would be more easily to be restrained or absorbed on the pores of bleaching material. Therefore at a high temperature, the equilibrium of bleaching process that was achieved did not take a long time compared with the low temperature. Therefore, Figure 1 (one) showed that at low temperatures of 140°C, 160°C and 180°C taking a long time in bleaching process, the absorption of red color was getting higher. This condition might cause the intensity of red color be decreasing so that its absorption was not optimal. Meanwhile at a low temperature, the oil condition having high viscosity might cause the red color contained in the oil would be very hard to be absorbed by the activated trass rock as the bleaching material. Based on our experiment conducted, to obtain the good absorption of red color, the duration of bleaching process required was 15 minutes with the heating temperature of 240°C. In this bleaching process, the equilibrium of red color's absorption had been reached. In this condition, the intensity of red color could be lowered from 59 to 15 (See Table 2 and 3) and the red color contained in palm oil could be well absorbed as much as 74,6%. However within 15 minutes, the equilibrium of red color's absorption had already been reached. Therefore, if bleaching process was still going on, the intensity of red color would increase again (See Table 3). This meant that the long duration of bleaching process would not provide the good result as we expected. Therefore, bleaching process had to be conducted very accurately and stopped in a precise time when the equilibrium of red color's absorption had been reached (Nwabanne, 2013).

CONCLUSION

Based on the discussion above it could be concluded that duration took an important role in bleaching process. However, the too long duration of bleaching could not provide a good result. Therefore, one thing to be considered was the equilibrium of red color's absorption. Soon after this stage had been already been reached, we had to stop it. Furthermore, to obtain the best result of palm oil, the duration of bleaching process required was 15 minutes with heating temperature of 240 °C. In this condition, the intensity of red color could be reduced from 59 to 15 and the intensity of yellow color could be increased from 30 to 38,9. Besides, the absorption of FFA could also be reduced from 1,98% to 1,44% and peroxide number could be reduced from 7,70 meq O_2/kg to 7,30 meq O_2/kg.

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